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Web-spinning Sawflies (Hymenoptera, Pamphiliidae) Feeding on Larch

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Abstract Web-spinning sawflies known to feed on larch are reviewed and four Palearctic species, one of them polytypic, of two genera are recognized and keyed. They are *Acantholyda nipponica* Yano & Sato, 1928, from Japan (Hokkaido, Honshu), *Acantholyda laricis* (Giraud, 1861) from Europe, Siberia, China and Japan (Honshu), *Cephalcia lariciphila lariciphila* (Wachtl, 1898) from Europe, Siberia and China, *Cephalcia lariciphila japonica* subsp. nov. from Japan (Hokkaido, Honshu), and *Cephalcia koebelei* (Rohwer, 1910) from Japan (Hokkaido, Honshu) and eastern Siberia. *Cephalcia baikalica* Verzhutskij, 1973, is newly synonymized with *C. koebelei*. These four species are actual or potential pests of larch plantations. Previous records of outbreaks of these sawflies in Japan are summarized.

Key words : Pamphiliidae, *Acantholyda*, *Cephalcia*, *Larix*, forest pest.

Larvae of the web-spinning sawflies of the genera *Acantholyda* and *Cephalcia* feed on conifer needles and some are notorious pests on spruce and larch. In Europe and Siberia, three species, *Acantholyda laricis* (Giraud, 1861), *Cephalcia lariciphila* (Wachtl, 1898) and *C. baikalica* Verzhutskij, 1973, are known to feed on larch, the second one often cited as a major pest in larch forests (Röhrg, 1953; Verzhutskij, 1966; Billany & Brown, 1980). In North America, Eidt (1969) noted on the occurrence of solitary pamphiliid larvae feeding on *Larix*, but this species has not been identified.

In Japan, Yano (1919, 1920) first reported on the severe damage of larch plantations in Yamanashi Prefecture, central Honshu, during 1912–1913 caused by “*Cephaleia kaebelei* [sic] Rohwer”. Since then, two cases of outbreaks of web-spinning sawflies in larch forests in Honshu have been recorded, one in Mt. Myoko-zan area, Niigata Prefecture during 1948–1954 (Anonymous, 1951, 1953, 1956) and the other on Mt. Hachibuse-yama, Nagano Prefecture during 1981–1982 (Kojima, 1983). These damages were also attributed to *Cephalcia koebelei* (Rohwer, 1910), but no detailed studies have been made on the systematics and biology of these insects.

Though larch is not indigenous to Hokkaido, it has been planted widely in the island for over a century (Inoue, 1958) and now it is regarded as one of the most important timber trees produced therein. No web-spinning sawflies associated with larch were known in Hokkaido until 1993, when severe defoliation of larch by *Cephalcia* larvae was found in Teshikaga, southeastern Hokkaido, which was soon

followed by the discovery of mass occurrence of two additional species of Pamphiliidae, an *Acantholyda* and a *Cephalcia*, in larch plantations in large areas south of Sapporo, western central part of Hokkaido (Maetô & Fukuyama, 1994, 1996; Fukuyama *et al.*, 1994, 1995; Saito, 1995; Mamiya *et al.*, 1995, 1997; Saito, 1996; Ito *et al.*, 1996, 1997; Saito *et al.*, 1996, 1997; Ito & Sasaki, 1996, 1997; Ito, 1997; Saito & Konishi, 1997 a, b). The *Acantholyda* species has been identified with *A. nipponica* Yano & Sato, 1928, but the identity of the two *Cephalcia* species has not been clarified (Maetô & Fukuyama, 1996). The three species of Pamphiliidae have most probably been introduced to Hokkaido by accident, though there is a narrow possibility that *A. nipponica*, attacking also *Pinus*, is native to Hokkaido.

Efforts to identify those species occurring in Hokkaido have led me to a review of the larch-feeding web-spinning sawflies of the world. Four Palearctic species of two genera, *Acantholyda nipponica* Yano & Sato, 1928, *Acantholyda laricis* (Giraud, 1861), *Cephalcia lariciphila* (Wachtl, 1891) and *Cephalcia koebelei* (Rohwer, 1910), are now known to feed on larch. The Japanese populations of *C. lariciphila* will be described as a new subspecies, as they show certain differences in coloration from the specimens occurring in Europe, Siberia and China. *Cephalcia baikalica* Verzhutskij, 1973, described from Bajkal region in eastern Siberia, has been found conspecific with *C. koebelei* as a result of my studies on Verzhutskij's original material.

The material used in this work is kept in the National Science Museum, Tokyo (NSMT) unless otherwise stated. Abbreviations for the deposition of the loaned material are: UOP—College of Agriculture, University of Osaka Prefecture, Sakai; USNM—United States National Museum, Washington, D. C.; ZISP—Zoological Institute, Academy of Sciences, St. Petersburg; ZMUM—Zoological Museum, University of Moscow, Moscow.

Acantholyda nipponica Yano & Sato, 1928

[Japanese name: Nihon-akazu-hirata-habachi]

(Fig. 1 A–B)

Acantholyda erythrocephala: Takeuchi, 1923, p. 363 [partim]. Nec Linnaeus, 1758.

Acantholyda (Acantholyda) nipponica Yano & Sato, 1928, p. 209.

Acantholyda nipponica: Takeuchi, 1930, p. 4; Takeuchi, 1938, p. 207; Takeuchi, 1949, p. 47; Takeuchi, 1955, p. 113; Okutani, 1967, p. 45; Shinohara & Smith, 1979, p. 283; Maetô & Fukuyama, 1996, p. 6; Ito *et al.*, 1996, p. 187; Ito & Sasaki, 1996, p. 75 [only Japanese name mentioned]; Ito & Sasaki, 1997, p. 55 [only Japanese name mentioned]; Ito, 1997, p. 13 [only Japanese name mentioned]; Ito *et al.*, 1997, p. 224 [only Japanese name mentioned].

Pamphiliidae sp. 3: Fukuyama *et al.*, 1995, p. 169.

Distribution. Japan (Hokkaido, Honshu).

Type material examined. ♀ (Lectotype) labeled “Chalast. No. 189” [red], “189,” “Lectotype, *Acantholyda nipponica* Yano et Sato, det. A. Shinohara, 1979”; 1♂ (paralectotype) labeled “Chalast. No. 189” [red].

Other material examined. JAPAN: HOKKAIDO: 5 ♀, 4 ♂, Maruyama, Tomakomai, Iburi, 5. VI. 1995, K. Fukuyama; 188 ♀, 185 ♂, Shikotsu-ko, Tomakomai, Iburi, 27. VI. 1995, A. Shinohara; 112 ♀, 68 ♂, Shikotsu-ko, Tomakomai, Iburi, 27. VI. 1995, H. Hara; 1 ♀, "Tomakomai, Hokkaido, 21. III. 1997, H. Hara" "Coll. 8. VIII. 1996 in larval stage, em. 21. III. 1997" "Host: *Pinus strobus*"; 52 ♀, 17 ♂, Shikotsu-ko, Chitose, Ishikari, 17. VI. 1996, A. Shinohara; 16 ♀, Shikotsu-ko, Chitose, Ishikari, 19. VI. 1997, A. Shinohara. HONSHU: Aomori Pref.: 1 ♀, Mt. Hakkôda-san, 16. VII. 1930, K. Kamiya. Miyagi Pref.: 3 ♀, 1 ♂, Sainogawara, Mt. Zaô-san, 25. VII. 1976, A. Shinohara. Saitama Pref.: 1 ♂, Nakaomaeda, Yorii, 4. IV. 1994, M. Uchida. Tokyo Met.: 1 ♂, "Meguro, 1917. V. 2" "189"; 3 ♀, 2 ♂, "189" [in K. Sato collection, NSMT, most probably collected with the types]; 1 ♀, Tokyo, 29. VII. 1931, M. Nakamura (UOP). Yamanashi Pref.: 1 ♀, Tokusa-tôge, 13–14. VI. 1987, H. Yamazaki. Nagano Pref.: 1 ♀, Kamiguchi [=Kamikochi], 6. VIII. 1912, Shibakawa (UOP); 1 ♂, Shioji-daira, Central Alps, Ina, 10. VIII. 1992, S. Tsuyuki. Ishikawa Pref.: 1 ♂, Mt. Haku-san, 23. VII. 1970, I. Togashi. Prefecture unknown: 1 ♀, Mt. Kamuro, 27. V. 1977, K. S.

Comparative comments. Among the Japanese species of *Acantholyda*, this species is readily recognized on its reddish head, somewhat metallic bluish black thorax and abdomen, and strongly infuscated wings, showing superficial resemblance to *Cephalcia isshikii* Takeuchi, 1930, a notorious pest of spruce in Hokkaido.

Acantholyda nipponica is closely related to *A. erythrocephala* (Linnaeus, 1758), which is a well-known defoliator of *Pinus* spp. occurring widely from Europe to Korea and the USA (accidentally introduced) but not found in Japan. *Acantholyda nipponica* differs from *A. erythrocephala* in having the apical half of the wings distinctly less infuscated than the basal half (wings uniformly infuscated in *A. erythrocephala*), the mandibles of the female mostly black (usually largely reddish brown in *A. erythrocephala*), the anterior tibia and tarsus in the female blackish brown (pale brown in *A. erythrocephala*), the mid and hind tibiae and tarsi in the male pale brown (blackish brown to black in *A. erythrocephala*), the abdominal sternum in the female with the posterior margin distinctly smoother and with denser punctures than the other part of the sternum (abdominal sternum rather uniformly finely striated, sparsely punctured in *A. erythrocephala*).

Another difference between *A. nipponica* and *A. erythrocephala* is in the mode of larval life; the larvae of the former species are solitary feeders (Maetô & Fukuyama, 1996; Ito *et al.*, 1996) whereas those of the latter live gregariously (Middlekauff, 1958; Pschorn-Walcher, 1982).

Variations. This species shows little variation and no geographical differences have been detected in my material. Female (374 specimens from Hokkaido and 12 specimens from Honshu examined): Length 9.5–16 (usually 11–15) mm. The ocellar area is often marked with black. In several small specimens, there is a blackish spot at each upper inner orbit. Male (274 specimens from Hokkaido and 8 specimens from

Honshu examined): Length 8.5–13 (usually 10–12) mm.

Host-plants. *Larix leptolepis* (Sieb. & Zucc.) Gord., *Pinus strobus* L. *Pinus densiflora* Sieb. & Zucc., *Pinus thunbergii* Parl. (Watanabe, 1937).

Remarks. This species was formerly regarded as a rare species associated with *Pinus* in Honshu and its occurrence in Hokkaido as a pest of *Larix* (Maetô & Fukuyama, 1996) was quite unexpected. Yano (1932) first recorded the host-plant of *A. nipponica* by simply stating “Larva feeds on leaves of pines”. Watanabe (1937) gave “Pines (*Pinus densiflora*, *Pinus Thunbergii*)” as the host of this pamphiliid in his catalogue of pests of trees in Japan without further comments. All the subsequent references to the host of *A. nipponica* (e.g., Takeuchi, 1949; Inoue, 1960; Okutani, 1967) are apparently based on the works of Yano and Watanabe and have provided no additional information. No data on the life history of this species have been published either. Thus, the host-plants and life history of the species were only obscurely understood. Now, *A. nipponica* has been found also in *Pinus strobus* forests (Ito, 1997; Ito & Sasaki, 1997) and one of the specimens examined was actually reared by Dr. H. Hara, Hokkaido Forestry Research Institute, Bibai, from a larva feeding on this pine. The four specimens collected on Mt. Zaô-san by myself were all swept from a five-needle pine, probably *Pinus parviflora* var. *pentaphylla*, which may possibly represent another host-plant. This is the only pamphiliid sawfly known to feed on both *Pinus* and *Larix*.

As discussed by Shinohara and Byun (1996), *A. nipponica* is endemic to Japan, the previous records of this species from Korea being doubtful, probably based on misidentification for *A. erythrocephala*.

The egg of this species is elongate-oval in shape (Photo 3 in Maetô & Fukuyama, 1996), much like those of *A. erythrocephala* (Linnaeus, 1758) (Middlekauff, 1958), *A. pumilionis* (Giraud, 1861) (Schedl, 1972), *A. flaviceps* (Retzius, 1783) (Vitasaari, 1975), and *A. servica* Vasić, 1966 (Vasić, 1966), all assigned to the subgenus *Acantholyda*. This is a normal type of egg in the family. On the other hand, known eggs of the species of the other subgenus *Itycorsia*, e.g., *A. flavomarginata* Maa, 1944 (Xiao *et al.*, 1991) *A. hieroglyphica* (Christ, 1791) (Charles & Chevin, 1977), *A. laricis* (Giraud, 1861) (Verzhutskij, 1973), *A. parki* Shinohara & Byun, 1996 (Lee, 1961), *A. peiyingaopaoa* Hsiao, 1963 (Xiao *et al.*, 1991), *A. posticalis* (Matsumura, 1912) (Roberti, 1951), and *A. zappei* (Rohwer, 1920) (Middlekauff, 1958), are all boat-, banana- or crescent-shaped, a peculiar feature confined to these species. Although the egg of one species assigned to *Itycorsia*, *A. piceacola* Xiao & Zhou, 1986, is somewhat differently shaped (“long ellipsoid, medially slightly curved” according to Xiao *et al.*, 1991), the obviously specialized, boat-shaped egg may be a good character to support the monophyly of the subgenus *Itycorsia*.

Acantholyda laricis (Giraud, 1861)

[Japanese name: Kiberi-hirata-habachi]

(Fig. 1 C-D)

Lyda laricis Giraud, 1861, p. 91.*Acantholyda laricis*: Takeuchi, 1938, p. 209 [partim]; Takeuchi, 1949, p. 47; Takeuchi, 1955, p. 113 [partim]; Inoue, 1960, p. 13; Verzhutskij, 1966, p. 20; Okutani, 1967, p. 44; Verzhutskij, 1970, p. 170; Verzhutskij, 1973, p. 79; Verzhutskij, 1981, p. 39; Pschorn-Walcher, 1982, p. 53; Achterberg & Aartsen, 1986, p. 12; Xiao *et al.*, 1991, p. 21.

For more references, see Klima (1937).

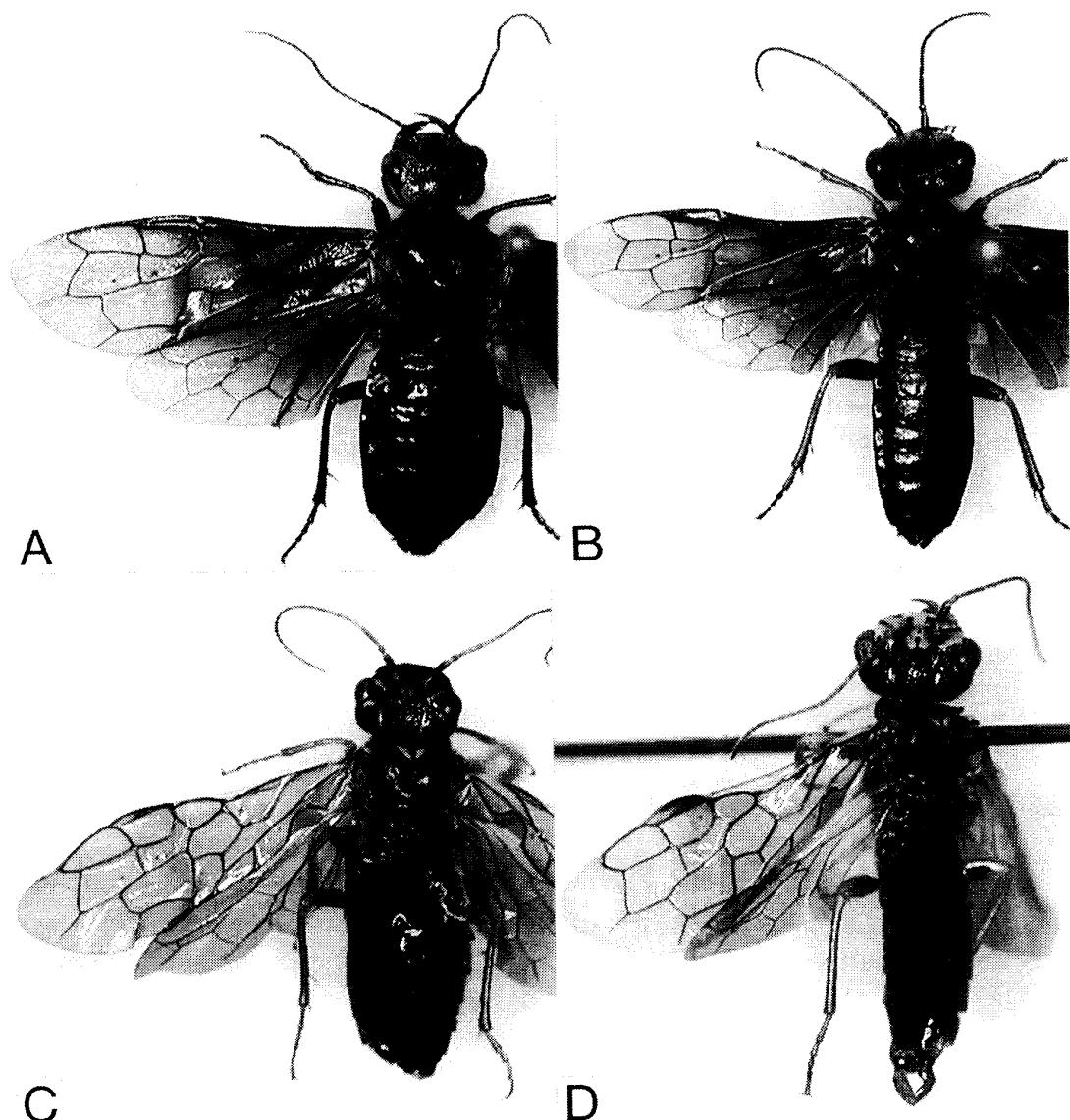


Fig. 1. *Acantholyda nipponica* (A-B) and *A. laricis* (C-D). A, ♀, Shikotsu-ko, length 14 mm; B, ♂, Shikotsu-ko, length 12 mm; C, ♀, Hôô-goya, length 10 mm; D, ♂, Minoto, length 8.5 mm.

Distribution. Europe to Siberia and China. Japan (Honshu).

Material examined. JAPAN: HONSHU: Yamanashi Pref.: 1 ♀, Hôô-goya, Mt. Hôô-zan, Nirasaki, 23. VII. 1988, K. Mizuno. Nagano Pref.: 1 ♀, Minoto, 1,900 m, Mts. Yatsugatake, 31. VII. 1982, A. Shinohara; 1 ♂, Minoto, 1,900 m, Mts. Yatsugatake, 6. VIII. 1982, A. Shinohara; 1 ♀, "Soihimura, Shinano, V. 1956, Takeuchi" (UOP); 1 ♂, Mt. Tateshina-yama, 1. VIII. 1980, K. Ushijima. ?GERMANY: 1 ♀, "Teg. 7.6. 89, Krchb." "89/86" "Acantholyda pinivora Ensl. ♀, E. Clément det." AUSTRIA: 1 ♀, "Larix 26/7" "Roghf. 1896/ N. Oestr. Neuhuus" "laricis, det. Kohl" "laricis Gir. ♀, det. Konow" "Acantholyda laricis (Gir.) ♀, det. W. Schedl 1979." ITALY: 1 ♀, "Trafoi, VII. 96." "Coll. Oldenberg" "Lyda laricis Gir. ♀, F. D. Morice det." "Acantholyda laricis (Gir.) ♀, det. A. Taeger 88." RUSSIA: 1 ♀, "r. Tom', 8 v., ot Tomska, Shafir. 11 VI. 01" "Lyda stellata Christ, F. Konow det. ♀" (ZISP). CHINA: 1 ♀, "North of Greater Chingan Mts., Manchuria, Base, 1942, Imanishi Exped."

Comparative comments. *Acantholyda laricis* is characterized as follows: Length 9–10.5 mm in female, 8.5 mm in male. Black, with pale yellow or brownish marking; mesoscutum usually with median and lateral lobes pale-marked; mesoscutellum usually entirely black; wings infuscated at least below stigma; stigma black in basal half and pale brown in apical half; abdomen black, with lateral margins of dorsum, laterotergites, and apical margins of sterna pale brown. Postgenal carina distinct; paraantennal field roundly swollen, very smooth and impunctate. This combination of characters will distinguish *A. laricis* from the other species of the genus, including the undetermined Japanese species mentioned below.

Variations. [Japan]: Female (3 specimens examined): Length 9.5–10 mm. One specimen from Minoto has no pale marks on the clypeus and the paraantennal field, and another specimen from Hôô-goya has no pale marking on the clypeus, while the remaining specimen has both the areas pale-marked. Pale marking on the median and lateral lobes of the mesoscutum are small but distinct, and the mesoscutellum is entirely black. Two specimens from Minoto and Hôô-goya have the mesepisternum with only the anterior margin narrowly pale yellow whereas one specimen from Soihimura has an additional very obscure pale mark medially on the mesepisternum. All the specimens have the wings rather strongly infuscated, the apical part beyond the stigma being more hyaline, and apical 1/3–1/2 of the stigma pale brown. Male (2 specimens examined): Length 8.5 mm. The two specimens are quite similar to each other. [Europe]: Female (3 specimens examined): Length 9–10.5 mm. One specimen from Teg has no pale marks on the clypeus. In all specimens, the pale marks on the mesoscutum are large and distinct, the mesoscutellum is entirely black, the cervical sclerite has a distinct pale spot, and the mesepisternum has large anterior and median pale marks. The wings are hyaline, with infuscation below the stigma and in the apical half of the hindwing. The stigma has its 1/2 pale brown. Male not examined. [Siberia]: Female (1 specimen examined): Length 9.5 mm. Coloration including that of the wings is similar to a pale European specimen, with pale marking very well-devel-

oped. The mesoscutellum has a very obscure transverse pale marking. The stigma has its 1/2–2/3 pale brown. Male not examined. [China]: Female (1 specimen examined): Length 9.5 mm. Similar to the Siberian specimen examined, but there is no pale marks on the mesoscutellum. Male not examined.

Host-plants. *Larix* sp. (specific names not given in European references). “Siberian Larch” (Verzhutskij, 1973). *Larix gmelinii* (Rupr.) Rupr. (Xiao *et al.*, 1991).

Remarks. This species seems usually uncommon all through its range, though Pschorr-Walcher (1982) noted that it is “not rare” in central Europe. There is only one record of outbreak that occurred in Ural, Russia, in the late 1950’s (Verzhutskij, 1966, etc.).

Takeuchi (1938) first recorded this species from Japan on the basis of three females and one male from mountains of central Honshu and no additional collection records have been published ever since. I have examined the male specimen from Kitazawa, Yamanashi Prefecture, kept in Takeuchi’s collection, UOP, and found that it actually belonged to a different, probably undescribed species. The remaining three specimens, two females from Nikko, Tochigi Prefecture, and another female from Kitazawa, were not traced in Takeuchi’s collection. It should be noted that there occur a couple of undetermined Japanese species which would come close to *A. laricis* in Takeuchi’s (1938) key.

Cephalcia lariciphila lariciphila (Wachtl, 1898)

[Japanese name: Yûrashia-karamatsu-hirata-habachi]

(Fig. 3 B)

Cephalcia lariciphila Wachtl, 1898, p. 93.

Cephalcia lariciphila: Beneš, 1976, p. 41; Billany & Brown, 1980, p. 71; Verzhutskij, 1981, p. 46; Pschorr-Walcher, 1982, p. 51; Achterberg & Aartsen, 1986, p. 21; Xiao *et al.*, 1991, p. 29.

Cephalcia alpina: Röhrig, 1953, p. 207; Takeuchi, 1955, p. 10 [partim]; Inoue, 1960, p. 23 [partim]; Verzhutskij, 1966, p. 24 [partim]; Verzhutskij, 1970, p. 171 [partim]; Verzhutskij, 1973, p. 80 [partim]; Xiao *et al.*, 1983, p. 875. Nec Klug, 1808.

Distribution. Europe to Siberia and China.

Material examined. THE NETHERLANDS: 1 ♀, Drente, Lager Westerbork, VI. 1944, E. A. M. Speijer; 1 ♂, Schayk, H. T. Larix, 9. V. 1944; 1 ♂, Schayk, H. T. Larix, 11. V. 1945. AUSTRIA/ITALY: 1 ♀, Brenner, Mai, 1914. SWITZERLAND: 1 ♀, Valais, Ferpécle, 5–7,000 ft., 21–27. VI. 1935, J. E. & R. B. Benson, B. M. 1935–581; 1 ♂, Valais, Saas-Fee, 7–8,000 ft., 21. VI. 1962, J. E. & R. B. Benson, B. M. 1962–404. AUSTRIA: 1 ♀, 1 ♂, Ötztaler Alpen, Tirol, Ochsenkopf, Gurpital, 1940 m, 18. VI. 1970, W. Schedl. CZECH: 1 ♂, Bretzova, south of Praha, 15–17. V. 1976, A. Shinohara; 1 ♂, Moravia, Kunicky, Kristek, IV; 1 ♂, Studinec, 23. VI. 1965. RUSSIA: 1 ♀, Khaptagaj, 35km YuYuV Yakutska, 6. VI. 1975, Kajmuk (ZISP); 1 ♂, Oktemtsy,

50 km YuYuZ Yakutska, Larix, 12. VI. 1976, E. Kajmuk (ZISP). CHINA: 1 ♂, Shanxi, Yuwu, 15. V. 1964.

Comparative comments. *Cephalcia lariciphila lariciphila* is recognized on the characters given in the key. For separating it from the other Palearctic congeners, more recent keys to the species of Europe (Beneš, 1976; Achterberg & Aartsen, 1986) and China (Xiao *et al.*, 1991) will be useful.

Variations. [Europe]: Female (4 specimens examined): Length 9.5–10.5 mm. The four specimens examined show little variation, as Beneš (1976) observed in his material. All have the antenna with the scape mostly black, the pedicel more or less black-marked, and the flagellum blackish with only a few basal segments whitish brown. The large pale mark on the mesepisternum is interrupted medially in two specimens. The hindtibia is more or less darkened in three specimens. Male (6 specimens examined): Length 8.5–10.5 mm. Two Dutch specimens have a small pale spot on the gena. Color of the antennal scape is variable but even in the palest specimen (from Moravia), the dorsal and ventral surfaces are blackish. In this specimen the pedicel is only weakly infuscated. The hindfemur is marked with black in two specimens. [Siberia]: Female (1 specimen examined): Length 10 mm. Quite similar to the European specimens, but the large pale marking on the mesepisternum is widely interrupted at middle and the posterior spot is quite obscure. The hind tibia has no distinct infuscation. Male (1 specimen examined): Length 10 mm. Similar to the European specimens, but the antennal scape is pale brown with a large black marking dorsally; the pedicel is black-marked basally. The hind femur is basally marked with black. [China]: Female not examined. Male (1 specimen examined): Length 9 mm. The pale genal spot is well developed, extending from the ventral part of gena nearly to the posterior end of the lateral suture. The antennal scape is largely black and the pedicel is rather obscurely marked with black basally.

Host-plants. *Larix leptolepis* (Sieb. & Zucc.) Gord., *Larix* *eurolepis* Henry, *Larix decidua* Miller (Billany & Brown, 1980). *Larix principis-ruprechtii* Mayr (Xiao *et al.*, 1991).

Remarks. This is a well known pest of larch in Europe (Röhrg, 1953; Billany & Brown, 1980) and China (Xiao *et al.*, 1983, 1991). It also infests larch in eastern Siberia, but the damage is not serious (Verzhutskij, 1966, 1970).

Cephalcia lariciphila japonica subsp. nov.

[Japanese name: Nihon-karamatsu-hirata-habachi]

(Figs. 2 A–B, 3 A, E, 4 A, C, E, G, 5 A–C, G)

? *Cephalcia koebelei*: Yano, 1919, p. 457 [*kaebelei!*]; Yano, 1920, p. 31 [*kaebelei!*]. Nec Rohwer, 1910.

? *Cephalcia alpina*: Takeuchi, 1955, p. 10 [partim]; Inoue, 1960, p. 23 [partim]. Nec Klug, 1808.

Cephalcia koebelei: Kojima, 1983, p. 171. Nec Rohwer, 1910.

Cephalcia sp.: Maetô & Fukuyama, 1994, p. 33; Mamiya *et al.*, 1995, p. 455; Mamiya *et al.*, 1997, p. 235.

Pamphiliidae sp.: Fukuyama *et al.*, 1994, p. 291; Saito, 1995, p. 63; Sato, 1996, p. 29; Sato *et al.*, 1996, p. 140; Saito & Konishi, 1997 a, p. 51; Saito & Konishi, 1997 b, p. 30; Sato *et al.*, 1997, p. 116.

Pamphiliidae sp. 1: Fukuyama *et al.*, 1995, p. 169.

Cephalcia sp. 1: Ito *et al.*, 1996, p. 190; Ito, 1997, p. 13; Ito *et al.*, 1997, p. 224.

Cephalcia sp. from Kawayu: Maetô & Fukuyama, 1996, p. 6.

Distribution. Japan (Hokkaido, Honshu).

Holotype: ♀, Nibushi, Teshikaga, Hokkaido, 15. VI. 1994, H. Hara.

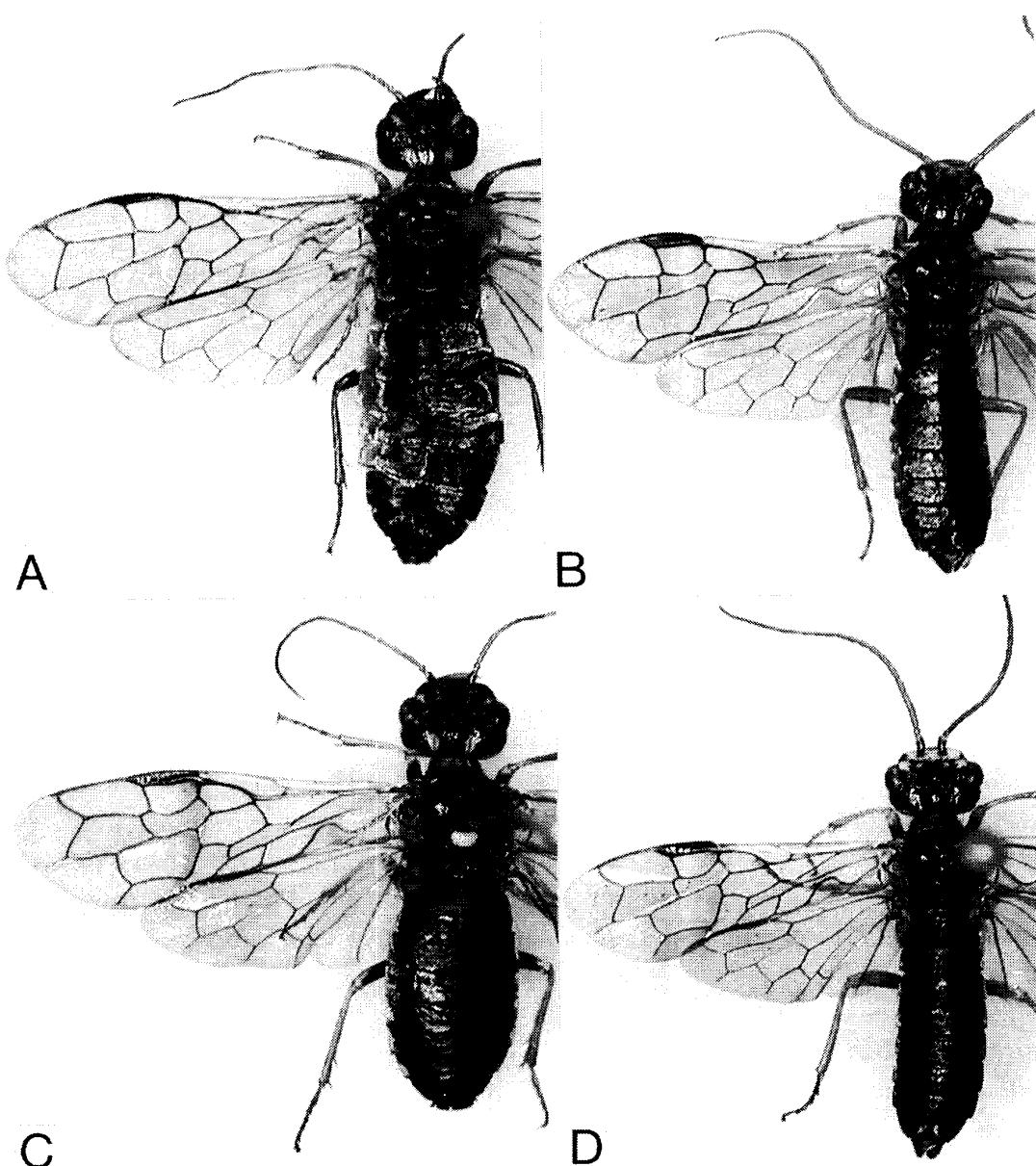


Fig. 2. *Cephalcia lariciphila japonica* (A-B) and *C. koebelei* (C-D). A, ♀, holotype, length 12 mm; B, ♂, paratotype, length 10 mm; C, ♀, Shikotsu-ko, length 10.5 mm; D, ♂, Shikotsu-ko, length 10.5 mm.

Paratypes: HOKKAIDO: 8 ♀, 56 ♂, Nibushi, Teshikaga, 15. VI. 1994, H. Hara; 5 ♀, 1 ♂, Nibushi, Teshikaga, 30. VI. 1994, H. Hara; 3 ♀, 2 ♂, Kussharo-Nibushi, 15. VI. 1994, K. Maetô; 1 ♀, Kussharo-Nibushi, larva on *Larix leptolepis* collected on 7. VIII. 1993, emerged on 10. VI. 1994, K. Maetô; 1 ♂, Kussharo-Nibushi, larva on *Larix leptolepis* collected on 7. VIII. 1993, emerged on 19. VI. 1994, K. Maetô. HONSHU: Tochigi Pref.: 1 ♀, Kirifuri, Nikko, 1 VI. 1969, A. Shinohara. Yamanashi Pref.: 1 ♀, Hôô-goya, Mt. Hôô-zan, Nirasaki, 21. VII. 1988, K. Hosoda; 1 ♂, Hôô-goya, Mt. Hôô-zan, Nirasaki, 23. VII. 1988, K. Mizuno; 1 ♀, Mizaishi-kosen, Mt. Hôô-zan, Nirasaki, 15. V. 1990, K. Hosoda. Nagano Pref.: 14 ♀, 52 ♂, Shimashima, 16. V. 1984, A. Shinohara; 1 ♀, 13 ♂, Shimashima, 10. V. 1989, A. Shinohara; 1 ♂, nr. Hora, Matsumoto City, 10–11. V. 1985, M. Nishimura; 1 ♀, 10 ♂, Mt. Hachibuse-yama, 1,900 m, Okaya, 12. VI. 1982; 1 ♀, Sebagawa, nr. Sugadaira, 15. V. 1979; 1 ♀, Minoto, 1,800 m, Mts. Yatsugatake, 4–8. VIII. 1987, A. Shinohara; 1 ♂, Akadake-kosen, 2,100 m, Mts. Yatsugatake, 24. VII. 1970, A. Shinohara.

Comparative comments. This new subspecies will be distinguished from the nominotypical subspecies by the characters given in the key. Most of the differences, though not very large, should be constant, as shown in the *Variations* sections of the both subspecies. Beneš (1976) pointed out that the nominotypical subspecies "shows only very slight colour and structural variability", and Achterberg and Aartsen (1986) used the partly blackish coloration of the antennal pedicel in the female of the nominotypical subspecies as a distinguishing character in their key to the European species.

Cephalcia lariciphila japonica closely resembles an unidentified species of *Cephalcia* feeding on spruce in Hokkaido (*Cephalcia* sp. 2 in Higashiura *et al.*, 1992). The latter is a slightly more robust species, with larger head possessing more clearly recognized pale marking. The male of the spruce-feeding species has (almost) entirely pale antennal scape and forefemur.

Variations. No geographical variations have been detected in my material, with the possible exception of the color of the antennal scape in the male, as noted below. Female (18 specimens from Hokkaido and 16 specimens from Honshu examined): Length 10–12.5 mm. The pale marks on the clypeus, gena and frons often become obscure, particularly in small specimens, and are sometimes completely missing (one specimen from Mizaishi-kosen is exceptionally dark, having the head almost entirely black). The color of the antenna is stable; the scape is black, with rather broad apical margin pale brown, the pedicel and the flagellum are pale brown, the apical part of the latter becoming blackish. The mesonotum usually has obscure pale marks on the mesoscutal median and lateral lobes and on the mesoscutellum, but these marks sometimes becomes obsolete or missing. All the specimens have the mesepisternum black, with only a small pale spot at the anterior margin, and the hind tibia entirely pale. The wings are subhyaline, without distinct blackish band below stigma. The latrotergites usually have no blackish marking. Male (60 specimens from Hokkaido

and 77 specimens from Honshu examined): Length 9–11.5 mm. The gena often has a pale spot. The antennal scape is usually pale brown, with an elongate blackish spot above. This spot is sometimes missing or enlarged to cover most of the dorsal surface

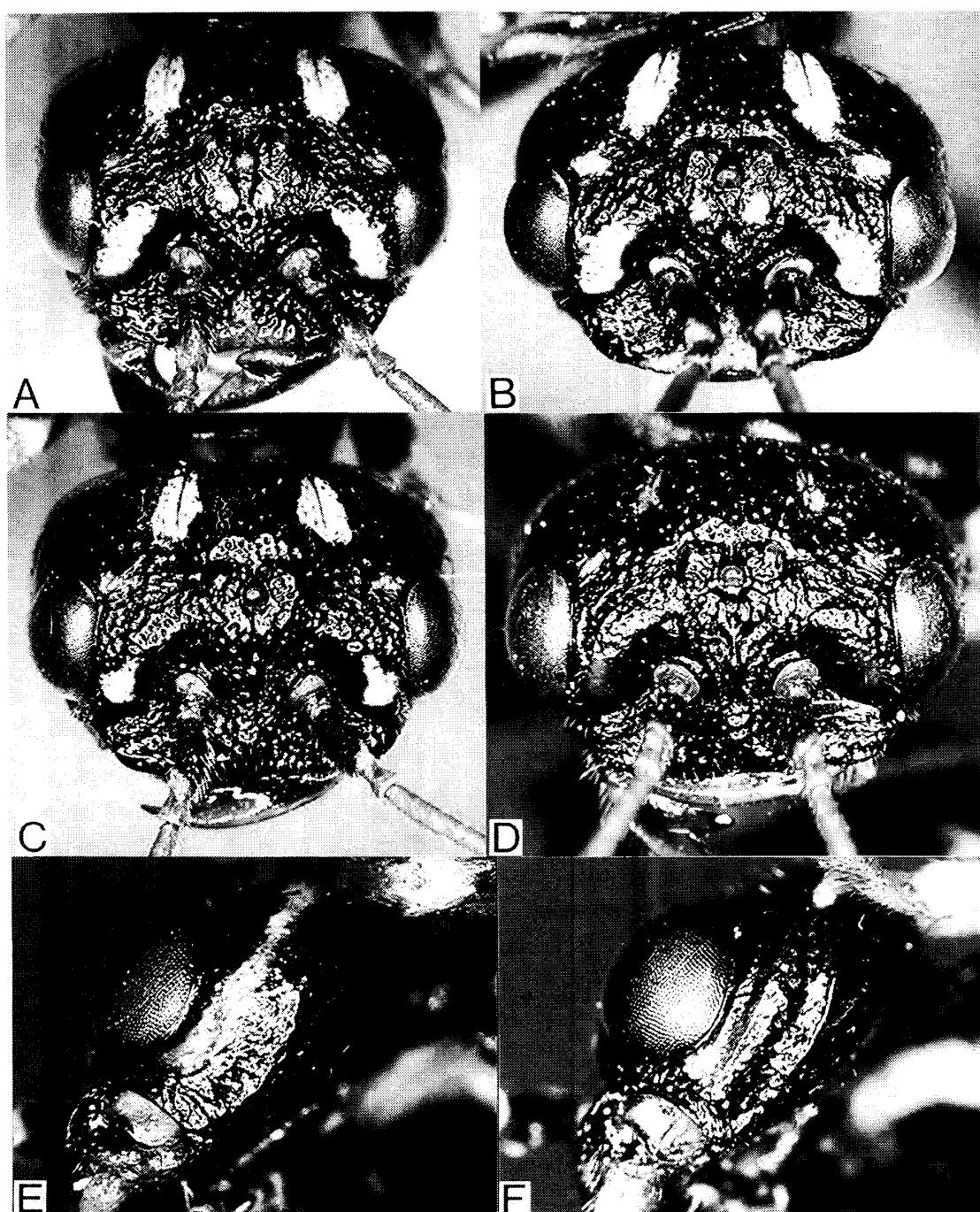


Fig. 3. *Cephalcia lariciphila japonica*, holotype (A, E), *C. lariciphila lariciphila*, Brenner (B), *C. koebelei*, Shikotsu-ko (C, F), and *C. koebelei*, holotype (?) of *C. baikalica* (D). A–D, Head, dorsofrontal view; E–F, gena, lateral view.

but the ventral surface as well as the entire pedicel are always pale in the Hokkaido specimens examined, whereas some of the Honshu specimens are more richly marked with black on the scape and have blackish marking on the pedicel. Thus a few exceptionally dark specimens are similar to a very pale specimen of the nominotypical subspecies. The hind femur is marked with black only in a few small specimens.

Host-plants. *Larix leptolepis* (Sieb. & Zucc.) Gord. (Kojima, 1983; Maetô & Fukuyama, 1994)

Remarks. Kojima (1983) reported on the outbreak of “*C. koebelei*” on Mt. Hachibuse-yama, Nagano Prefecture, and outlined its life history. Through the courtesy of Dr. T. Okutani, formerly Kobe University, I was able to study a series of specimens collected on Mt. Hachibuse-yama during the mass occurrence, and confirmed that they actually belonged to *C. lariciphila japonica*. As discussed under *C. koebelei*, Yano’s (1919, 1920) records of *C. koebelei* from Yamanashi Prefecture might also be referable to this subspecies.

***Cephalcia koebelei* (Rohwer, 1910)**

[Japanese name: Karamatsu-hirata-habachi]

(Figs. 2 C–D, 3 C–D, F, 4 B, D, F, H, 5 D–F, H)

Cephaleia (Cephaleia) koebelei Rohwer, 1910, p. 101; ? Yano, 1920, p. 31 [*kaebelei!*].

Cephaleia koebelei: ? Yano, 1919, p. 457 [*kaebelei!*]; Takeuchi, 1923, p. 363; Takeuchi, 1930, p. 5.

Cephalcia koebelei: Takeuchi, 1938, p. 215; Takeuchi, 1949, p. 47; Anonymous, 1951, p. 29 [only Japanese name mentioned]; Anonymous, 1953, p. 27 [only Japanese name mentioned]; Anonymous, 1956, p. 88 [only Japanese name mentioned]; Inoue, 1960, p. 23; Okutani, 1967, p. 45.

Cephalcia baikalica Verzhutskij, 1973, p. 82; Verzhutskij, 1981, p. 45. **Syn. nov.**

Pamphiliidae sp. 2: Fukuyama *et al.*, 1995, p. 169.

Cephalcia sp. 2: Ito *et al.*, 1996, p. 190; Ito, 1997, p. 13; Ito *et al.*, 1997, p. 224.

Cephalcia sp. from Eniwa: Maetô & Fukuyama, 1996, p. 6.

Cephalcia sp.: Ito & Sasaki, 1996, p. 75; Ito & Sasaki, 1997, p. 55.

Distribution. Japan (Hokkaido, Honshu). Russia (Bajkal region).

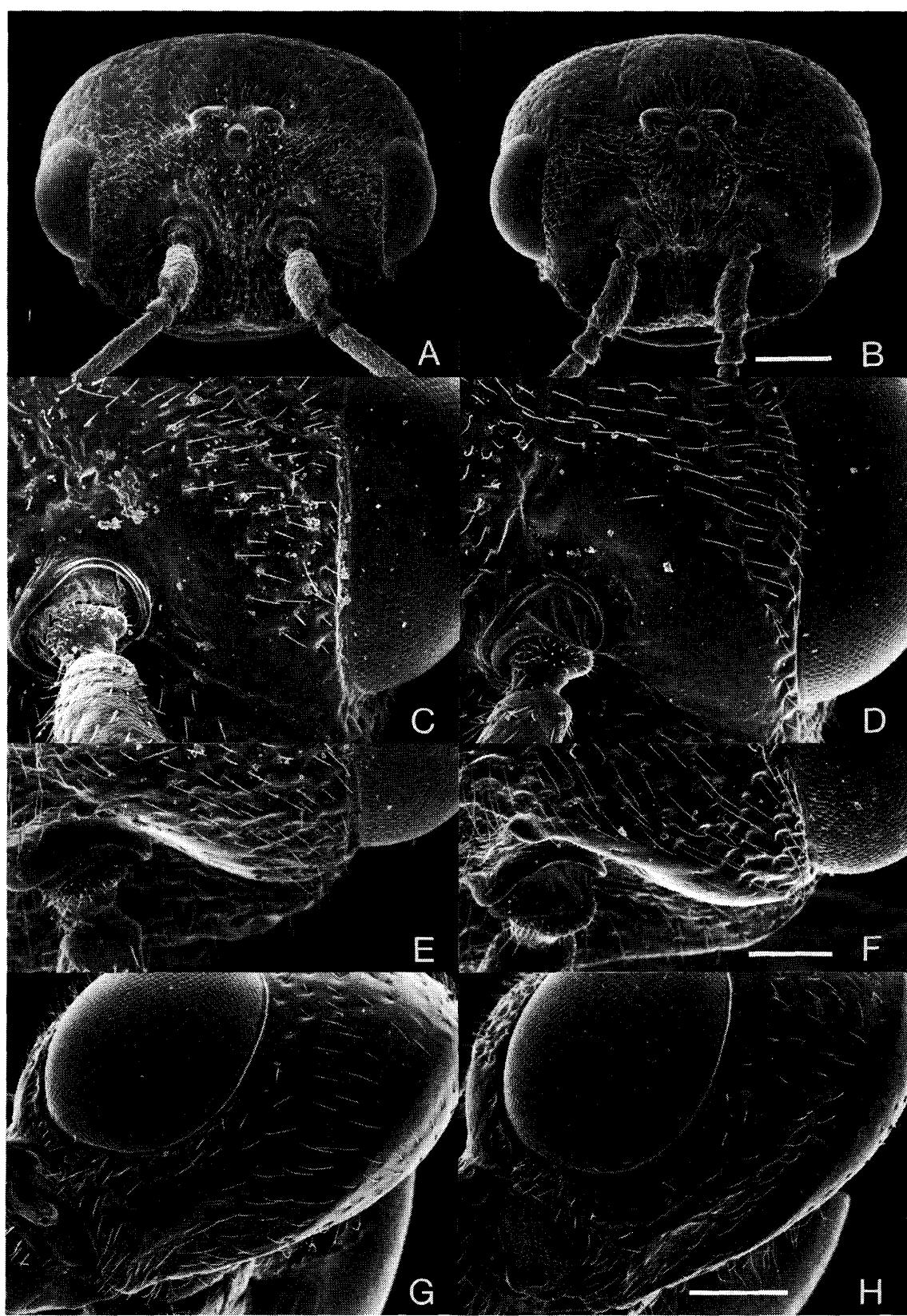
Type material examined. ♂ (holotype of *C. koebelei*) labeled “Japan Koebele,” “♂ Type No. 13313, U.S.N.M.” “*Cephalcia koebelei* Roh. Type ♂” (USNM). ♀ (holotype of *C. baikalica* ?; see discussion below), “Irkutsk. r-n., s. M. Goloustnoe, s. [?] 38, 16. VII. 65, otl. [?], B. Verzhutskij, 21. VII. 65” [original in Cyrillic], “*Cephalcia baikalica* Wersh. sp. n., ♀, B. Wershutsky det. 1968” [original in Roman] (in coll Verzhutskij).

Other material examined. JAPAN: HOKKAIDO: 87 ♀, 6 ♂, Shikotsu-ko, Tomakomai, Iburi, 27. VI. 1995, A. Shinohara; 96 ♀, 5 ♂, Shikotsu-ko, Tomakomai, Iburi, 27. VI. 1995, H. Hara; 2 ♀, 1 ♂, Shikotsu-ko, Chitose, Ishikari, 17. VI. 1996, A. Shinohara; 7 ♀, 2 ♂, Shikotsu-ko, Chitose, Ishikari, 19. VI. 1997, A. Shinohara; 3 ♀, 4 ♂, Eniwa, Ishikari, 14. VI. 1995, K. Fukuyama; 3 ♀, 1 ♂, Sapporo, 22–23. VI. 1994, K. Maetô. HONSHU: Niigata Pref.: 1 ♂, “Myoko, Niigata, 30-VII ‘51, Karamatsu

[=*Larix*]” “*Cephalcia koebelei* Rohwer, det. Takeuchi, ‘55” (UOP). Yamanashi Pref.: 2 ♂, Mizaishi-kosen, Mt. Hôô-zan, Nirasaki, 31. VII. 1987, S. Tsuyuki; 1 ♀, 3 ♂, Mizaishi-kosen, Mt. Hôô-zan, Nirasaki, 12. VIII. 1989, K. Mizuno; 9 ♂, Mizaishi-kosen, Mt. Hôô-zan, Nirasaki, 4. VIII. 1992, K. Mizuno. Nagano Pref.: 2 ♀, 3 ♂, Tenshojihara, Tateshina, 29. VII. 1972, A. Shinohara; 1 ♀, Minoto, 2,000 m, Mts. Yatsugatake, 4. VIII. 1984, A. Shinohara. RUSSIA: 1 ♀, “prav. b. Leny, yu. Yakutska, Khaptagaj, L. Zimina, 9. VII. 1974” (ZMUM); 1 ♂, “Irkutsk. r-n., s. M. Goloustnoe, s. Larix [?] les, B. Verzhutskij, 12. VII. 65” “*Cephalcia alpina* (Kl.), ♂, B. Wershutsky det. 1968.”

Comparative comments. *Cephalcia koebelei* is characterized as follows: Length 8–11.5 mm in female, 8–11 mm in male. Black, with pale yellow or brownish marking. Mesoscutum often with median and lateral lobes obscurely pale-marked and mesoscutellum pale yellow in female, and these areas usually entirely black in male; wings subhyaline, usually with inconspicuous infuscated band below stigma in female; stigma black; abdomen black, with lateral margins of dorsum, outer margins of laterotergites, and narrow apical margins of sterna pale yellow. Paraantennal field roundly swollen, smooth and impunctate. This species is most closely allied to *C. lariciphila*; distinguishing characters are given in the key.

Variations. [Hokkaido]: Female (198 specimens examined): Length 9–11.5 mm. The clypeus is usually entirely black (Fig. 3 C) but has a very obscure small pale mark in 23 specimens and a rather distinct, inverted T-shaped mark only in two specimens. The supraocular spot is sometimes missing. The ventral margin of the lateral pronotum is narrowly pale in all specimens and the posterolateral corners of the dorsal pronotum are entirely black or sometimes very narrowly pale yellow. The mesoscutum is usually entirely black, but the median lobe as well as the posterior part of each lateral lobe often obscurely marked with pale yellow. The hind coxa often bears pale yellow marking ventrally. Male (19 specimens examined): Length 9–11 mm. The pale yellow mark on the clypeus is always separated from pale yellow mark on the paraantennal field, the former having a pair of small blackish spots inside. The pale spots on the upper inner orbits and along the lateral sutures usually missing or obscure. The posterolateral corners of the dorsal pronotum have no pale areas. The dorsal (posterior) surfaces of fore and mid femora are constantly marked with black and often also the hind femur. The hind coxa often bears pale yellow marking ventrally. [Honshu]: Female (4 specimens examined): Two specimens from Tenshojihara are 9 mm and 10 mm long, respectively, and have pale yellow marks on the clypeus, ventral margin of the lateral pronotum, posterolateral corners of the dorsal pronotum and the mesoscutal median lobe (the marking on the last part is almost missing in one specimen). One specimen from Mizaishi-kosen is only 8 mm long and similar to the Tenshojihara specimens, except that the spots on the mesoscutal median lobe are nearly missing. One specimen from Minoto is 9.5 mm long and has the clypeus entirely black, the supraocular spot missing, ventral margin of the lateral

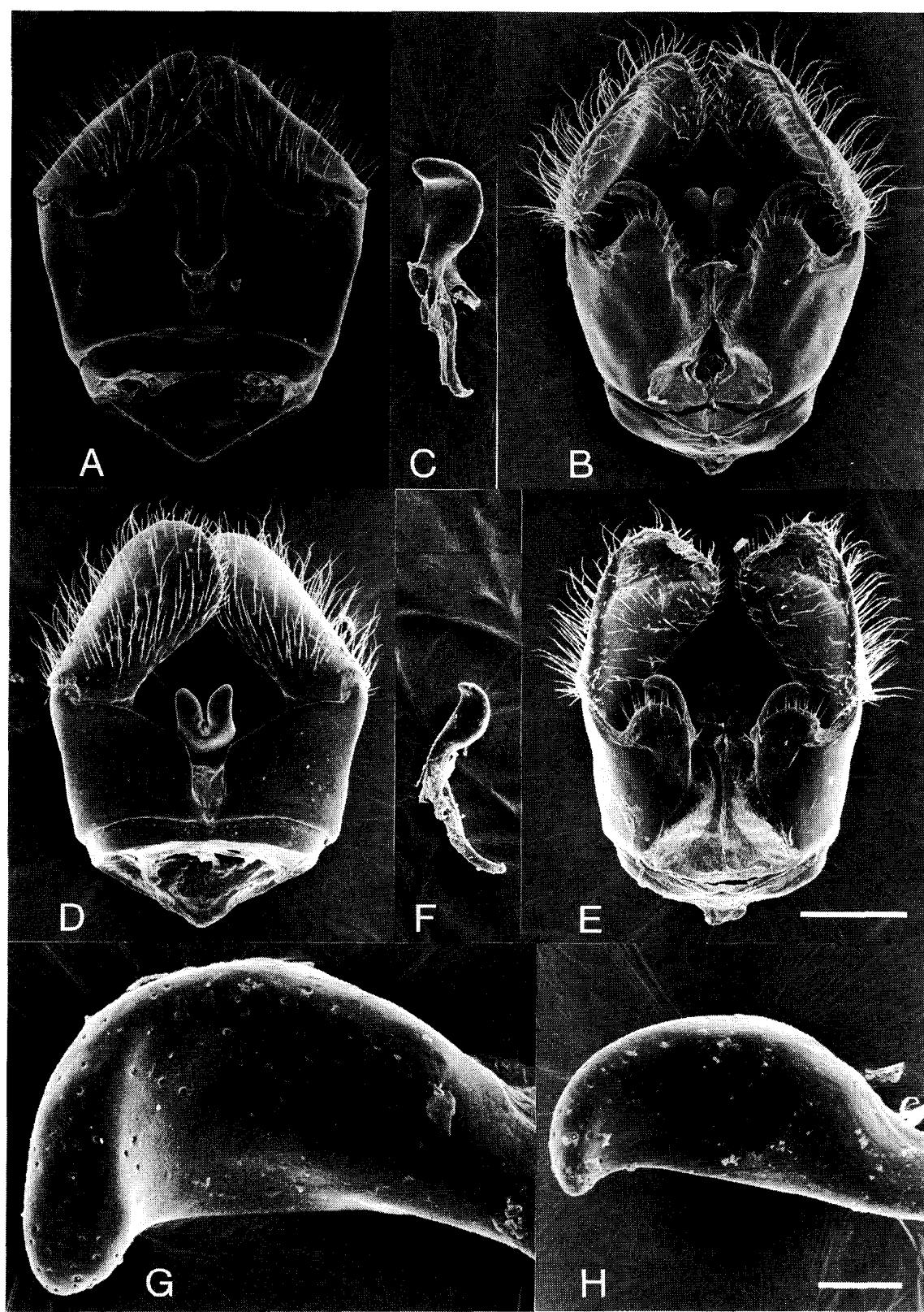


pronotum and posterolateral corners of the dorsal pronotum narrowly pale yellow, and the mesoscutal median lobe with a pair of small pale yellow spots. Male (18 specimens examined): Length 9–11 mm. Three specimens from Tenshojihara are much like the Hokkaido specimens in that the pale marks on the clypeus and paraantennal fields are well separated, a pair of small blackish spots are present in the clypeal pale marking, pale marks are missing at the upper inner orbits and along the lateral sutures, and posterolateral corners of the dorsal pronotum are entirely black, and the fore and mid femora are largely marked with black. All the specimens from Mizaishi-kosen, with only one exception, have the pale yellow marks on the clypeus and paraantennal field fused, with no black line disconnecting them, and the clypeal yellow mark has no blackish spots in it; in one specimen, the three pale marks are broadly separated but black spots are absent in the clypeal pale marking. In this series, a small spot at each upper inner orbit and an oblong spot along each lateral suture are often present, and the posterolateral corners of the dorsal pronotum are more or less marked with pale yellow. The black areas on the femora are much less developed than the Hokkaido specimens, and in a few specimens they are missing or nearly so. The holotype and the Myoko specimen are similar to the average specimen from Mizaishi-kosen; there are no pale marks at the upper inner orbits and along the lateral sutures, and fore and mid femora are marked with black. All the Honshu males have pale yellow marking on the ventral surface of the hind coxa. [Siberia]: Female (2 specimens examined): The specimen from Bajkal region is 10.5 mm long and dark-colored, having no pale marks on the clypeus, pronotum and mesoscutum, and ventral surface of hind coxa, and pale marks on the other parts of the head becoming smaller and obscure (Fig. 3 D). The specimen from Yakutsk region, possibly somewhat abnormal as suggested by its short distorted wings, is 11 mm long and still darker than the Bajkal specimen; the pale mark on the paraantennal field is nearly missing and the mesoscutellum has only an obscure pale yellow marking. Male (1 specimen examined): Length 8 mm. The pale mark on the clypeus is narrowly separated from the pale mark on the paraantennal field by a fine blackish line, the former pale area having no blackish spots inside. There are no pale marks at the upper inner orbits and along the lateral sutures, and the posterolateral corners of the dorsal pronotum are marked with pale yellow. The ventral surface of the hind coxa is largely pale yellow and black marking on the femora is entirely missing.

Host-plants. *Larix leptolepis* (Sieb. & Zucc.) Gord.

Remarks. *Cephalcia koebelei* was the only species of *Cephalcia* known to feed on *Larix* in Japan, and all the previously recorded infestations of larch by pamphiliids were attributed to this species. Yano (1919, 1920) reported on the outbreak of a web-

Fig. 4. *Cephalcia lariciphila japonica* (A, C, E, G), Nibushi, and *C. koebelei* (B, D, F, H), Shikotsu-ko. A–B, Head, dorsofrontal view; C–D, paraantennal field, dorsofrontal view; E–F, do., dorsal (or posterodorsal) view; G–H, gena, lateral view. Scales: 0.5 mm for A–B, 0.2 mm for C–F, and 0.3 mm for G–H.



spinning sawfly, “*Cephaleia koebelei* [sic] Rohwer,” injurious to larch in Yamanashi Prefecture, central Honshu, but it should be noted that his brief description of the female adult (Yano, 1920) might also, or even better, agree with *C. lariciphila japonica*. Concerning the head color pattern, he only referred to the yellow marking on the “base of the lip and areas lateral to it”, which probably means the marks on the clypeus and paraantennal fields. In *C. koebelei*, the pale mark on the clypeus is very often missing or inconspicuous if present (see *Variations* above), whereas it is almost constantly present in *C. lariciphila japonica*. The web-spinning sawfly which occurred in Mt. Myoko-zan area around 1950 (Anonymous, 1951, 1953, 1956) is doubtless *C. koebelei*, because one of the specimens of this species examined is labeled “Myoko, Niigata, 30-VII '51, Karamatsu [=Larix].” On the other hand, the species that infested larch on Mt. Hachibuse-yama in early 1980's (Kojima, 1983) is actually *C. lariciphila japonica*, as discussed under that species.

I have examined a male and a female of *C. baikalica* from Verzhutskij's collection and found that they are conspecific with *C. koebelei*. The following circumstantial evidence may suggest that the female specimen is actually the holotype of *C. baikalica*, though it is not so labeled. Verzhutskij (1973), when describing *C. baikalica*, gave a description of the larva which was reared from the egg laid on “17. VII. 1965” by a female collected in “rajone Irkutska (s. M. Goloustnoe).” He also gave a brief diagnosis of the adults and simply mentioned “Holotype, female, found in the author's collection” without giving collection data of the holotype. Eight years later, Verzhutskij (1981) redescribed the female in detail apparently on the basis of a female specimen collected near “d. M. Goloustnoe” on “16. VII. 1965” (one day before the oviposition was made; see above), which may be regarded as the holotype. The female specimen examined, which came to me through the courtesy of Dr. K. Beneš, Prague, was collected by Verzhutskij in M. Goloustnoe on 16. VII. 1965 and bears his own identification label, “*Cephalcia baikalica* sp. n.”

Key to Web-spinning Sawflies Feeding on Larch.

1. Foretibia with one preapical spine (genus *Acantholyda*). 2.
- Foretibia without preapical spine (genus *Cephalcia*). 3.
2. Postgenal carina absent (subgenus *Acantholyda*). Larger species, length usually 11–15 mm in female and 10–12 mm in male. Head mostly reddish brown in female and black with clypeus, supraclypeal area and paraantennal fields yellow in male; thorax and abdomen black with faint bluish metallic luster; antenna entirely black; wings strongly infuscated with black, the infuscation weaker in apical half; stigma entirely black (Fig. 1 A–B). Japan (Hokkaido,

Fig. 5. *Cephalcia lariciphila japonica* (A–C, G), Nibushi, and *C. koebelei* (D–F, H), Shikotsuko, male genitalia. A, D, Dorsal view; B, E, ventral view; C, F, penis valve, lateral (left) view; G, H, valviceps, lateral (left) view. Scales: 0.3 mm for A–F and 0.05 mm for G–H.

Honshu) *Acantholyda nipponica* Yano & Sato

— Postgenal carina distinct (subgenus *Itycorsia*). Smaller species, length 9–10.5 mm in female and about 8.5 mm in male. Head, thorax and abdomen black, with pale yellow or brownish marking; antenna with flagellum largely pale; wings infuscated at least below stigma; stigma black in basal half and pale brown in apical half (Fig. 1 C–D). Europe to Siberia and China; Japan (Honshu). *Acantholyda laricis* (Giraud)

3. Paraantennal field scarcely convex, largely rugose or punctate in dorsal and outer part and smooth in ventral and inner part (Fig. 4 C, E); facial crest flattened, indistinct; pronotum at least with broad posterolateral corners yellow; hind coxa black, with only narrow apical margin pale yellowish. Female: clypeus usually with pale marking; frons often with pair of small pale spots in front of ocelli (Fig. 3 A–B); posterior part of gena scarcely concave along usually blunt postgenal carina; genal groove usually shallow and indistinct (Figs. 3 E, 4 G); broad vertical pale line on gena usually entire, extending from ventral part of gena nearly to posterior end of lateral suture, or reduced, with only dorsal part left; mesoscutal lateral lobe usually with pale marking; mesoscutellum entirely black or with obscure pale mark (Fig. 2 A); laterotergites with or without black marks. Male: clypeus usually with inverted T-shaped yellow marking, which is never connected with rather narrow yellow mark on paraantennal field; each laterotergite and subgenital plate usually without blackish mark; genitalia as in Fig. 5 A–C, G; valviceps large. Larva living in loosely woven net-like tube without frass (see Photo 4 in Maetô & Fukuyama, 1996)..... *Cephalcia lariciphila*...a

a. Female: Antenna with scape mostly black, only narrow apex pale; pedicel more or less black-marked (Fig. 3 B), and flagellum blackish with only a few basal segments whitish brown; broad vertical pale line on gena entire, extending from ventral part of gena nearly to posterior end of lateral suture; mesepisternum with large elongate whitish marking on each lateral surface, which is often interrupted at middle or posterior part reduced; hindtibia often infuscated; forewing with inconspicuous but distinct blackish band below stigma; laterotergites more or less marked with black. Male: Antenna with scape usually largely black; pedicel usually more or less black-marked. Europe to Siberia and China. *C. lariciphila lariciphila* (Wachtl)

— Female: Antenna with apex of scape usually broadly pale brown, pedicel and flagellum pale brown, the former without black marking (Fig. 3 A) and the latter becoming blackish apically; broad vertical pale line on gena often reduced, with only dorsal part left; mesepisternum with only small spot at anterior margin whitish yellow; hindtibia not infuscated; forewing usually without distinct blackish band below stigma; laterotergites usually without blackish marking. Male: Antenna with scape usually pale brown, more or

less marked with black dorsally; pedicel without black marking. Japan (Hokkaido, Honshu). *C. lariciphila japonica* subsp. nov.

— Paraantennal field roundly swollen, mostly smooth, nearly impunctate, dorsally demarcated by rather distinct facial crest (Fig. 4 D, F); pronotum usually entirely black dorsally, at most with very narrow posterolateral corners yellow; hind coxa black, with narrow apical margin and very often spot on ventral surface pale yellowish. Female: clypeus usually entirely black; no paired small pale spots in front of ocelli (Fig. 3 C–D); posterior part of gena rather deeply concave along sharply defined postgenal carina; genal groove deep and distinct (Figs 3 F, 4 H); broad vertical pale line on gena usually interrupted; mesoscutal lateral lobe usually without pale marking; mesoscutellum usually entirely pale yellow (Fig. 2 C); laterotergites black basally and dirty yellow marginally. Male: clypeus largely yellow and sometimes connected with large yellow mark on paraantennal field; each laterotergite and subgenital plate with blackish mark basally; genitalia as in Fig. 5 D–F, H; valviceps small. Larva living in densely woven tube covered with frass (see Photo 5 in Maetô & Fukuyama, 1996). Siberia; Japan (Hokkaido, Honshu).....
..... *Cephalcia koebelei* (Rohwer)

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